

# Screening for Microscopic Hematuria in School-age Children of the Gorgan City

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Screening for hematuria was carried out in 3000 school-age children (6 to 14 years old) in Gorgan, Iran, using a fresh morning urine sample. At the initial step, 208 (6.8%) had positive dipstick tests for blood, which decreased to 35 (1.2%) at the second step. Of the 35 children with hematuria, 27 (77.1%) were girls and 8 (22.9%) were boys. Twenty-six children were further evaluated of whom 5 had normal findings, and 7 had hypercalciuria, 13 had nephrolithiasis, and in 1 had a large cystic lesion on ultrasonography, ultimately diagnosed as oncocystoma.

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Macroscopic hematuria is visible to the naked eye, but microscopic hematuria is usually detected by a dipstick test during a routine examination. Hematuria is confirmed by microscopic examination of the spun urine sediment. Test tape study of urine is a very simple and cheap procedure that can be done as a screening program and can detect serious problems at early stage.<sup>1-3</sup> However, the sensitivity and specificity of the dipstick method for detecting blood in the urine is varying. When tested on urine samples in which a predetermined amount of blood has been placed, dipsticks have a sensitivity of 100 and a specificity of 99 in detecting 1 to 5 erythrocytes per high-power field.<sup>4</sup> This corresponds to approximately 1 to 5 intact erythrocytes per liter of urine.<sup>5</sup> There is no consensus on the definition of microscopic hematuria, although more than 5 to 10 erythrocytes per high-power field is considered significant.<sup>4</sup> Documentation of at least 2 of 3 urinalyses showing microscopic hematuria over 2 to 3 weeks is recommended before further evaluation is performed.<sup>6</sup>

The American Academy of Pediatrics recommends screening urinalysis at school entry (at 4 to 5 years of age) and once during adolescence (at 11 to 21 years of age) as a component of well child care.<sup>4</sup> Microscopic hematuria is a common finding in

unselected school-age children between 6 to 15 years, as indicated by a positive dipstick for blood in a single urine sample.<sup>7</sup> The incidence of microscopic hematuria in school-age children was estimated at 0.41% when 4 urine samples per child were collected and 0.32% in girls and 0.14% in boys when 5 consecutive urine specimens were analyzed over 5 years.<sup>1,2</sup> Microscopic hematuria in 2 or more urine samples is found in 1% to 2% of children aged 6 to 15 years old.<sup>1,2</sup>

There is a long list of causes of microscopic hematuria, most of which are benign, especially in children presenting with isolated asymptomatic microscopic hematuria.<sup>7</sup> Hematuria is one of the most important signs of kidney or bladder disease. This study was undertaken in children aged 6 to 15 years old (school-age population) to assess them for asymptomatic hematuria. The objective of this study was to review the important causes of hematuria in children and to describe a plan for evaluation.

The study protocol was approved by the Institutional Ethics Committee of Golestan University of Medical Sciences. This study was done on primary school and middle school-age children (6 to 14 year old) in Gorgan, Iran, from 2009 to 2010. The importance of the study and study plan

was discussed with educational staff and school teachers. The children were randomly selected for the study. Only asymptomatic school age children were included. Each morning, 30 students attended to the hospital with their teachers and a urine sample collected from them. The midstream urine samples were collected in clean wide mouth jars and examined with dipsticks for specify gravity, pH, hematuria, proteinuria, glycosuria, and other abnormalities in urine. In all positive cases, repeated urine sample collections were tested and examined by light microscopy. The diagnostic studies reviewed included serum creatinine, blood urea nitrogen, serum electrolyte studies, serum complement concentration, antinuclear antibody, urinalysis, urine calcium-creatinine and protein-creatinine ratios, 24-hour urinary protein excretion, renal ultrasonography, intravenous pyelography, and voiding cystourethrography.

All positive cases for blood were evaluated for history of exercise, urolithiasis, fever, hypertension, urinary tract infection, recent bladder catheterization, and other diseases associated with hematuria, as well as familial history of renal disease, deafness, and end-stage renal disease.

This study was done on 3000 school-age children (1200 girls and 1800 boys). At the initial step, 208 children (6.8%) had a positive dip sick test for blood, which decreased to 35 (1.2%) at the second step (Table). Of the latter group, 27 (77.1%) were girls and 8 (22.9%) were boys. They were evaluated for dysmorphic erythrocytes, proteinuria, and any casts in their urine. Those with positive test results had blood sample for assessment of complement, antinuclear antibody, anti-double stranded DNA, and hepatitis B surface antigen and antibody. All of them had ultrasonography and blood pressure measurement done. Children who had negative results on urine examination for dysmorphic erythrocytes and proteinuria were evaluated for crystalluria. Parents of 9 children refused further evaluations. In the remaining 26 children, 5 had normal findings, while 7 had hypercalciuria, 13

had nephrolithiasis, and 1 had a large cystic lesion on ultrasonography. The latter child underwent surgical operation and the pathologic study revealed oncocystoma. All creatinine and electrolyte values were normal for age, and none of the biochemical tests obtained in the children with hypercalciuria were abnormal.

In many parts of the world, urinalysis is a simple screening test for kidney diseases in preschool children. This test is very useful and inexpensive. Since 1998, all school age children in Korea must have annual urinalysis. The first early morning urine specimen is examined by a simple dipstick method for the detection of proteinuria, hematuria and glucosuria. Cho and Kim assessed urinalysis data of the school urinalysis screening and analyzed the results of clinical data and renal biopsy findings of patients with abnormal urinalysis.<sup>8</sup> By 2004, about 5 million students had been screened since the annual school urinalysis started in January 1998. Among them, the prevalence rate of isolated proteinuria was about 0.2%, occult blood was about 0.8%, and glucosuria was about 0.07%. Renal biopsy had been carried out for referred patients. Histopathological findings were immunoglobulin A nephropathy in 43.8%, mesangioproliferative glomerulonephritis in 38.4%, Henoch-Schönlein nephritis in 2.7%, membranoproliferative glomerulonephritis in 1.6%, and lupus nephritis in 0.5%. Alport disease was detected in 0.6% of the children as a hereditary disease.<sup>8</sup>

In a retrospective study performed in New York by Feld and colleagues,<sup>9</sup> of 325 children referred for the evaluation of asymptomatic microscopic hematuria, only 18 had abnormal renal ultrasonography examinations, and 9 voiding cystourethrographies showed low-grade reflux. Hypercalciuria was found in 29 patients. The family history was positive for urolithiasis in 16% of the patients without hypercalciuria, as compared with 14% of patients with hypercalciuria. A positive family history of hematuria was reported in 25% of the patients; 62 patients did not have hypercalciuria and 4 of the patients had hypercalciuria.<sup>9</sup> Microscopic hematuria was a benign finding in the vast majority of the children.<sup>9</sup> Vehaskari and colleagues<sup>2</sup> screened an unselected population of 8954 children, aged 8 to 15 years, for hematuria. Four urine specimens from each were examined; microscopic hematuria was found in one or more

Prevalence of Hematuria Among School-age Children of Gorgan

Group	Total Number	Hematuria (%)	
		First Test	Second Test
Boys	1800	92 (5.1)	8 (0.4)
Girls	1200	116 (9.7)	27 (2.3)
All children	3000	208 (6.9)	35 (1.2)

specimens in 4.1%, and in 2 or more specimens in 1.1% of the children. The prevalence was not age or sex dependent. Those with 2 or more positive samples were re-examined twice during a half-year period, which revealed that 33 had hematuria of 6 or more erythrocytes per 0.9 mm<sup>3</sup>. Renal biopsy performed on 28 of them revealed 2 cases of immunoglobulin A nephropathy, 1 focal segmental sclerosis, 1 extracapillary glomerulonephritis, and 1 possible hereditary nephritis. In 12 patients, the biopsy was entirely normal, and the rest showed equivocal changes. Co-existing proteinuria and the degree of hematuria correlated well with the severity of the morphologic alterations. Pathologic findings in microscopic hematuria seemed to be less frequent than in hematuria in general. The authors concluded that in most such patients, renal biopsy was probably not indicated.<sup>2</sup> In 2009, Badeli and coworkers investigated the prevalence of proteinuria and hematuria in 4- to 6-year-old children in daycare centers in Rasht, Iran. They tested 1520 children for proteinuria and hematuria and reported a prevalence of 5.8 % for proteinuria and 3.2% for hematuria.<sup>10</sup>

In the comparison with these studies, the prevalence of hematuria in our first and second test were similar to the rates reported by Vehaskari and colleagues.<sup>2</sup> We have found that hematuria has been more prevalent in females as compared to males. Hypercalciuria in our patient was similar to that reported by Feld and colleagues.<sup>9</sup>

Microscopic hematuria is defined by more than 5 erythrocytes per high-power field. Persistent microscopic hematuria needs evaluation. Most children with isolated microscopic hematuria do not have any serious cause of hematuria and do not require extensive evaluation.<sup>4</sup> A finding of isolated hematuria or proteinuria on random urine screening can be distressing to pediatric patients and their families. However, available information continues to support the fact that most patients have a benign and transient condition. These data demonstrate that a renal ultrasonography, voiding cystourethrography, cystoscopy, and renal biopsy are not indicated in the workup of microscopic hematuria, and microscopic hematuria in the otherwise healthy child is a minimal health threat,

rarely indicative of serious illness.<sup>9</sup>

In conclusion, screening school-age children by urinalysis is an inexpensive test that could detect chronic kidney disease in its early stage. Early detection and confirmatory diagnosis by renal biopsy seems to be helpful for assessment of prognosis and intervention of chronic kidney disease progression.

## CONFLICT OF INTEREST

None declared.

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